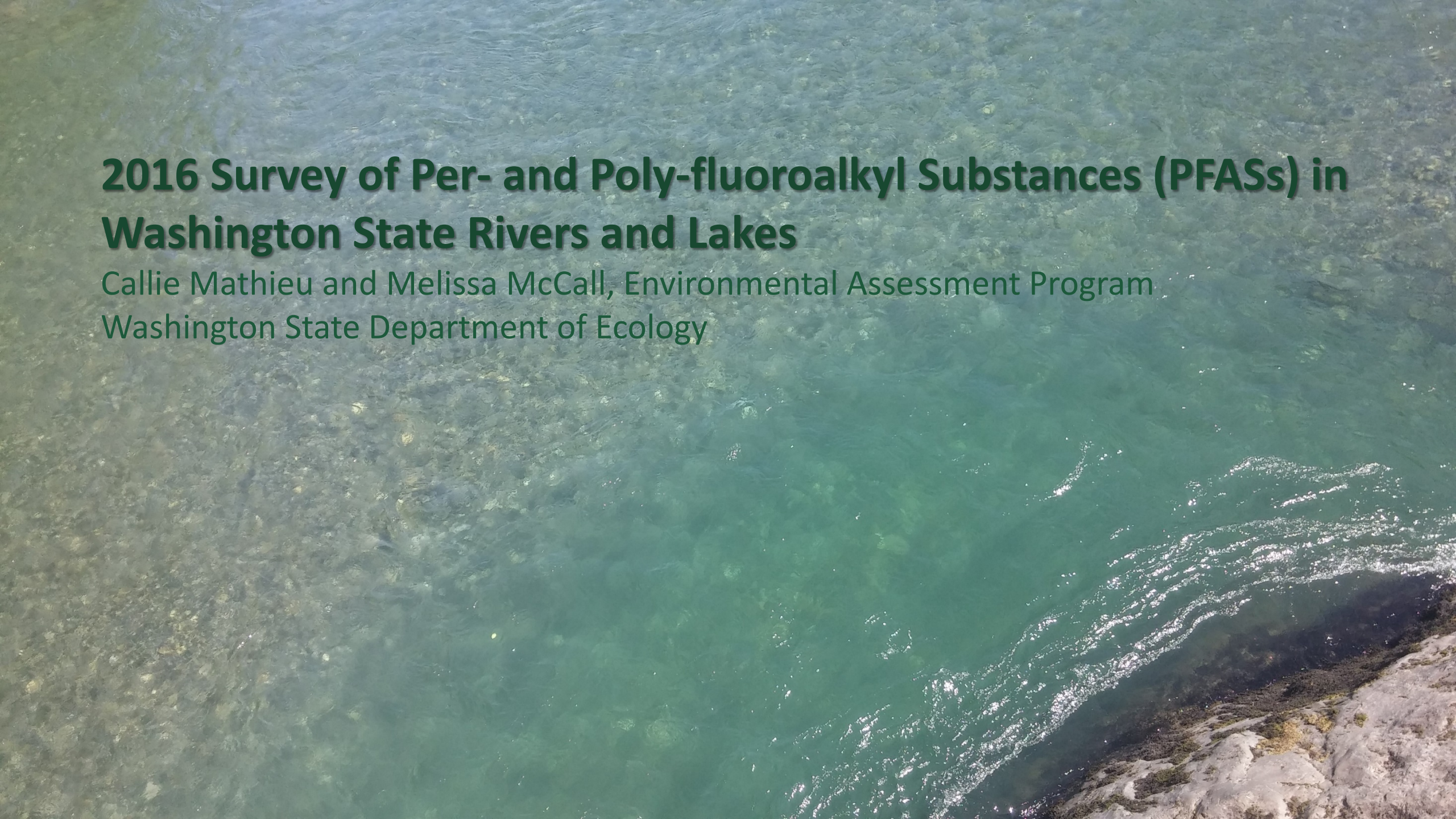
Apr 4th, 3:30 PM - 3:45 PM

Survey of per- and poly-fluoroalkyl substances (PFASs) in Washington State rivers and lakes

Callie Mathieu
Washington State Dept. of Ecology, United States, callie.mathieu@ecy.wa.gov

Melissa McCall
Washington State Department of Ecology, United States, melissa.mccall@ecy.wa.gov

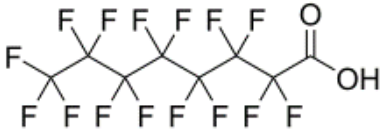


2016 Survey of Per- and Poly-fluoroalkyl Substances (PFASs) in Washington State Rivers and Lakes

Callie Mathieu and Melissa McCall, Environmental Assessment Program
Washington State Department of Ecology


Holts
HANDY
OIL
+TEFLON
LICHTE SMEEROLIE
HUILE FINE

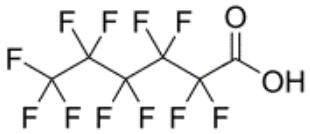
PFOS = C8



PFOA = C8

Long-chain perfluoroalkyl acids

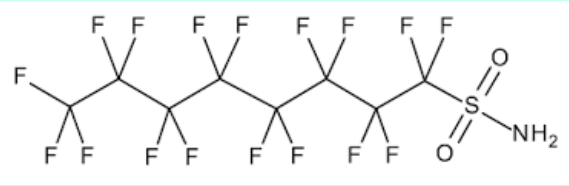
long chain	PFHxS	C6
	PFOS	C8
	PFOA	C8
	PFNA	C9
	PFDA	C10
	PFUnA	C11
	PFDoA	C12



PFHxA = C6

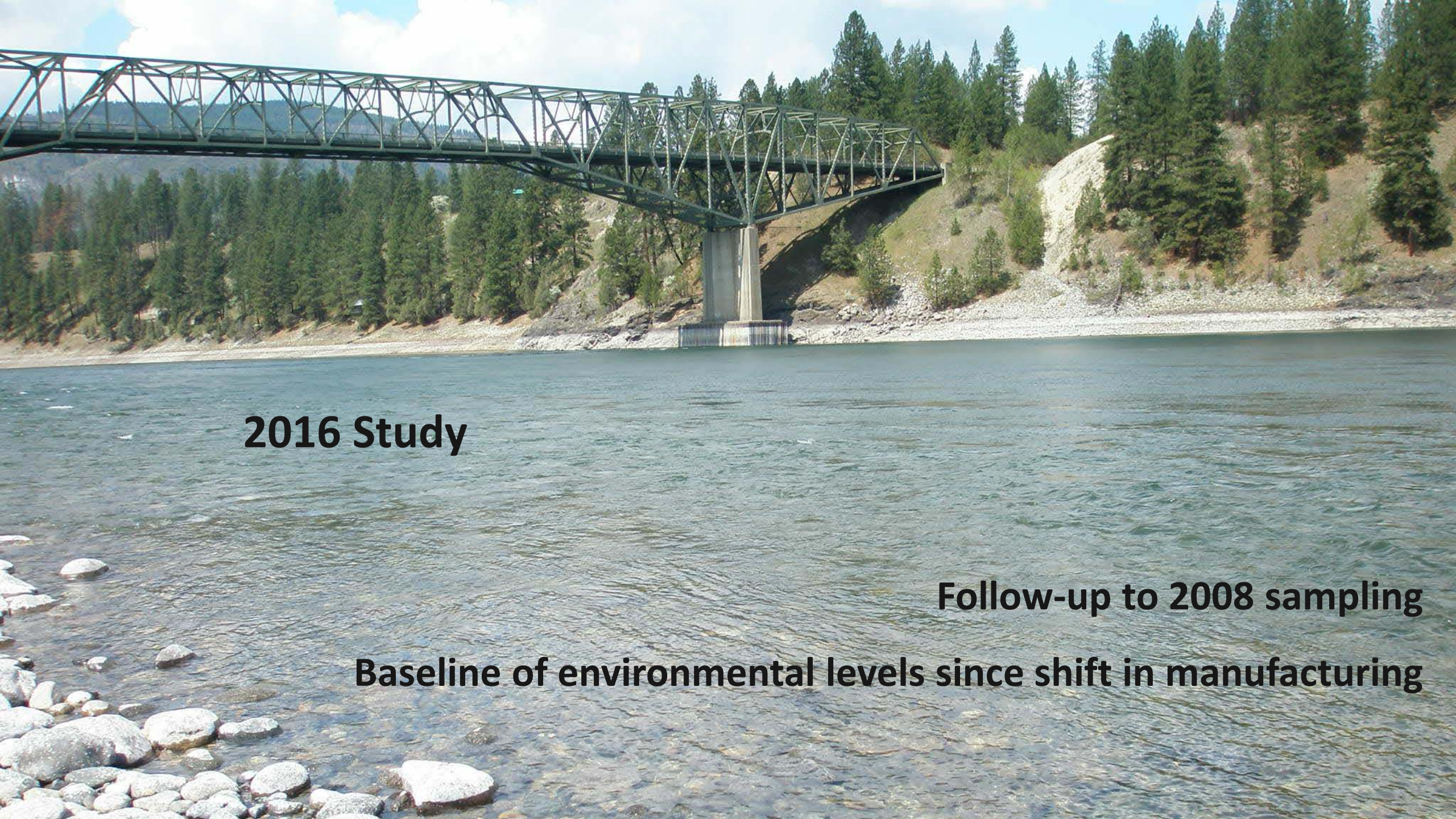
Short-chain perfluoroalkyl acids

short chain	PFBS	C4
	PFBA	C4
	PFPeA	C5
	PFHxA	C6
	PFHpA	C7



Precursors

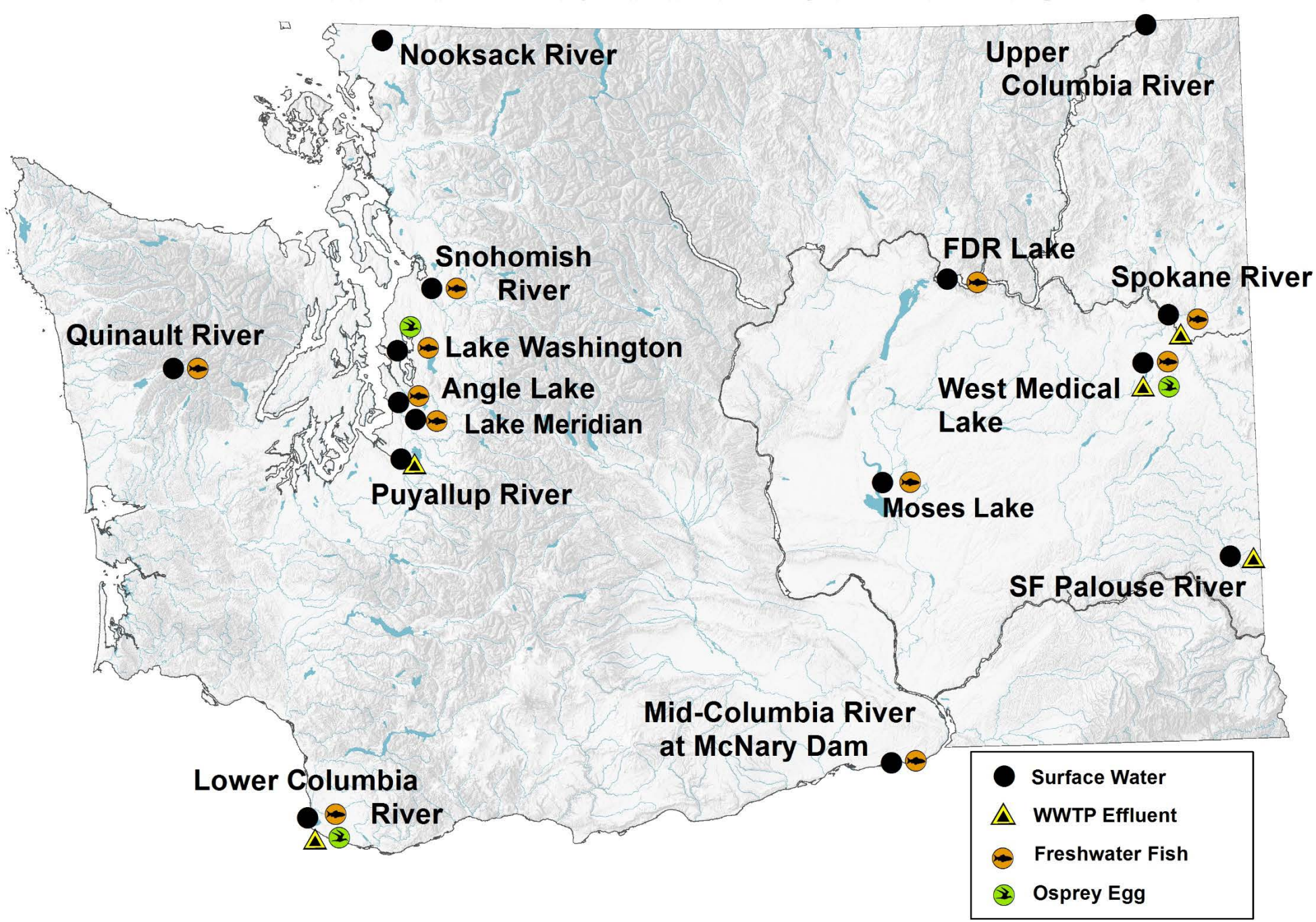
polyfluorinated sulfonamides
fluorotelomer carboxylates
fluorotelomer sulfonates
polyfluorophosphates



2016 Study

Follow-up to 2008 sampling

Baseline of environmental levels since shift in manufacturing

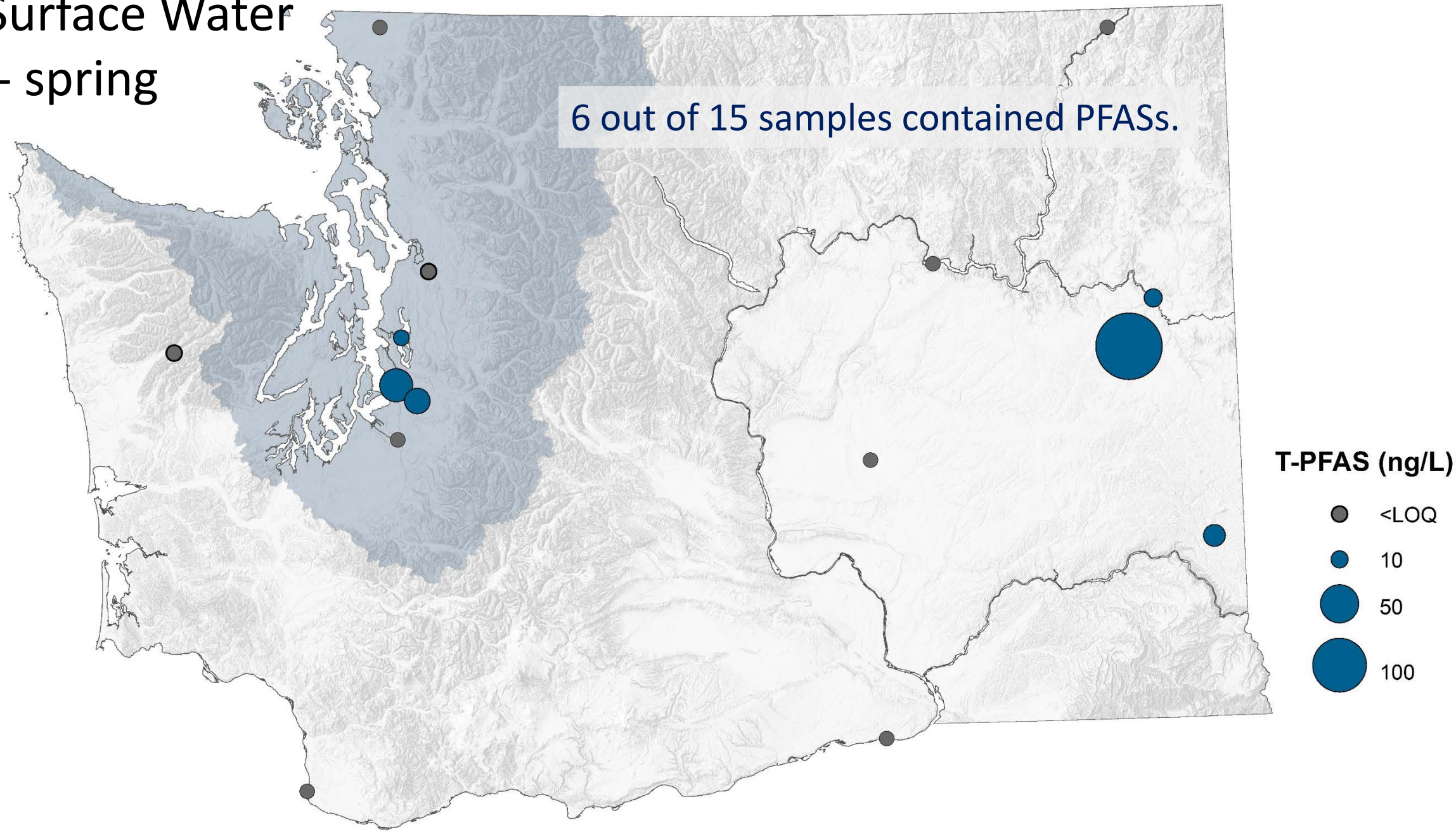

Nooksack River
Upper Columbia River
Snohomish River
FDR Lake
Spokane River
Quinault River
Lake Washington
Angle Lake
Lake Meridian
West Medical Lake
Puyallup River
Moses Lake
SF Palouse River
Mid-Columbia River at McNary Dam
Lower Columbia River
Surface Water
WWTP Effluent
Freshwater Fish
Osprey Egg

Surface Water

Discrete grab samples

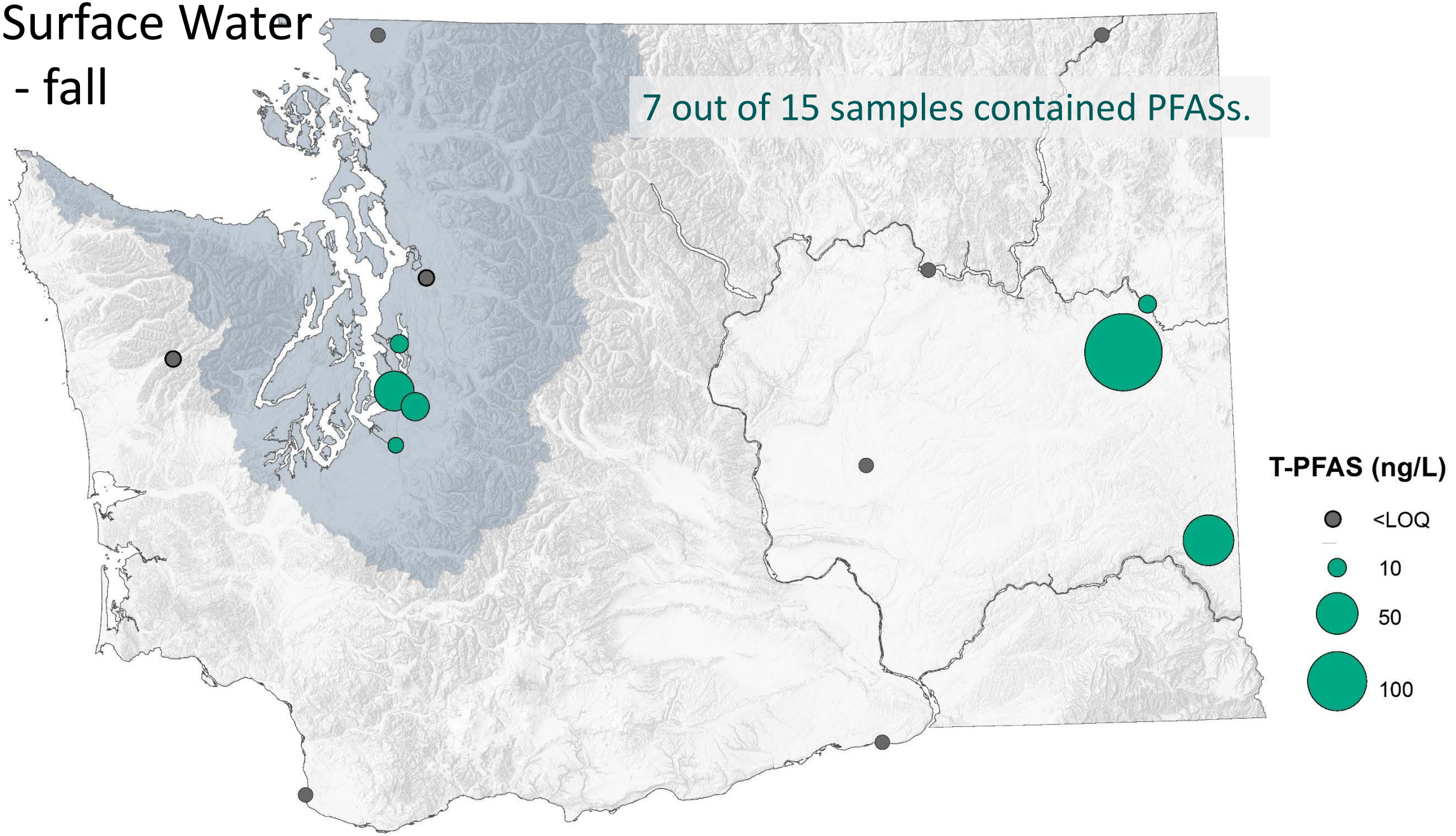
25 compounds

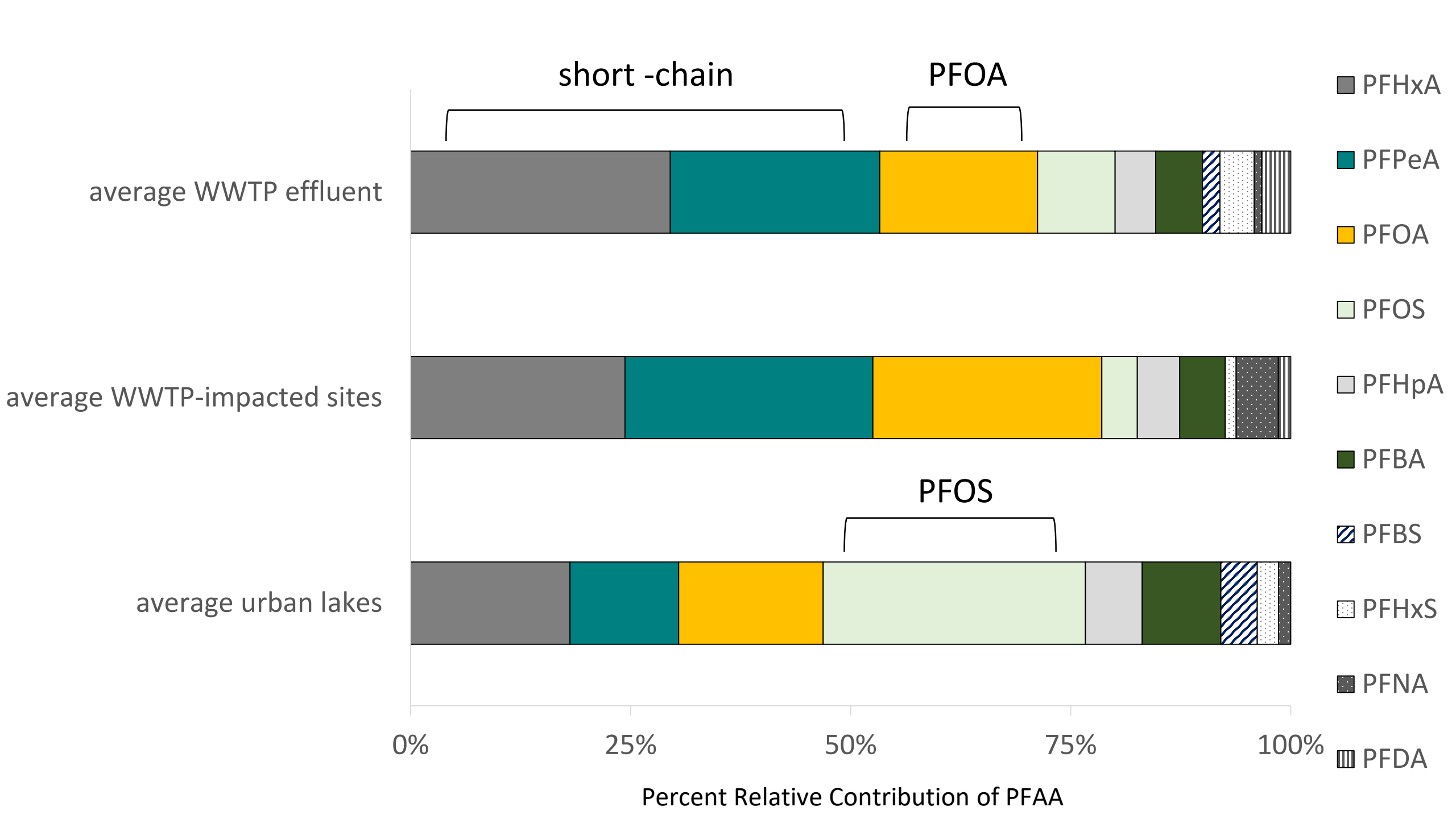
Surface Water - spring



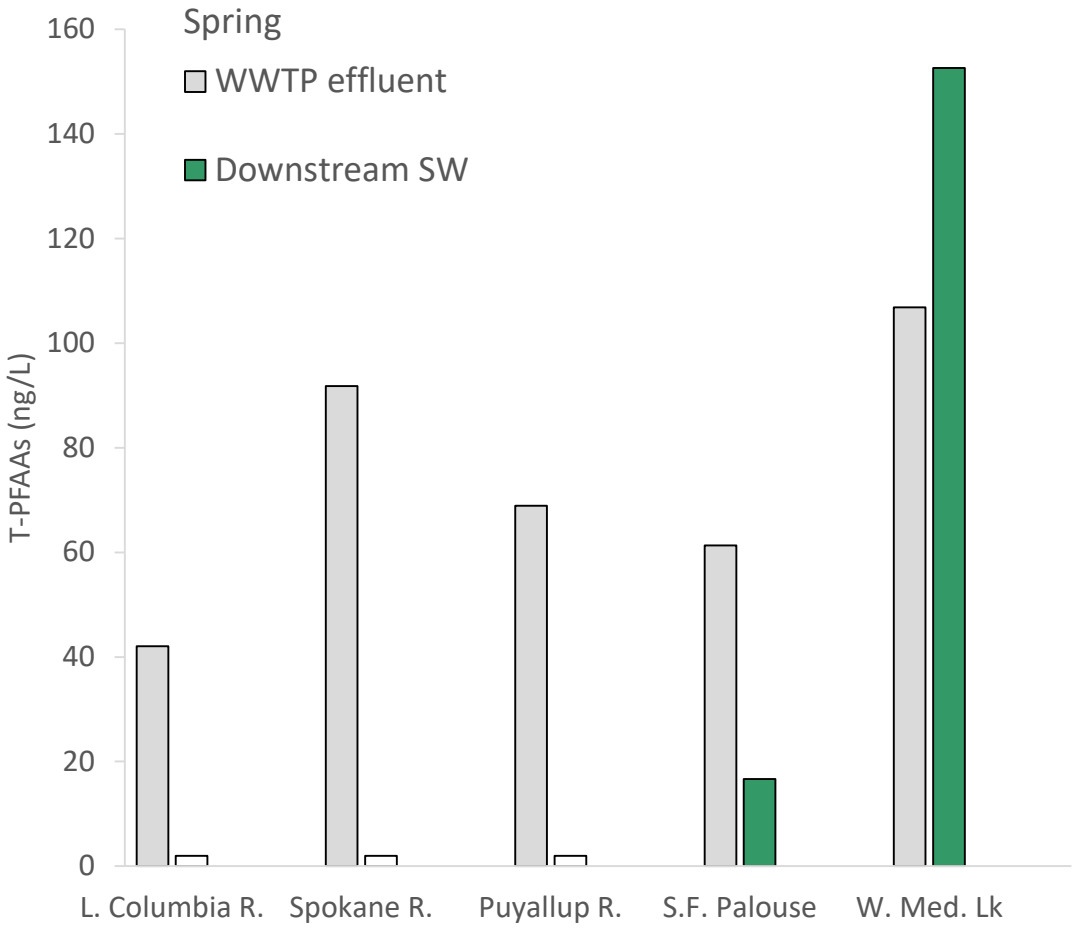
Surface Water - fall

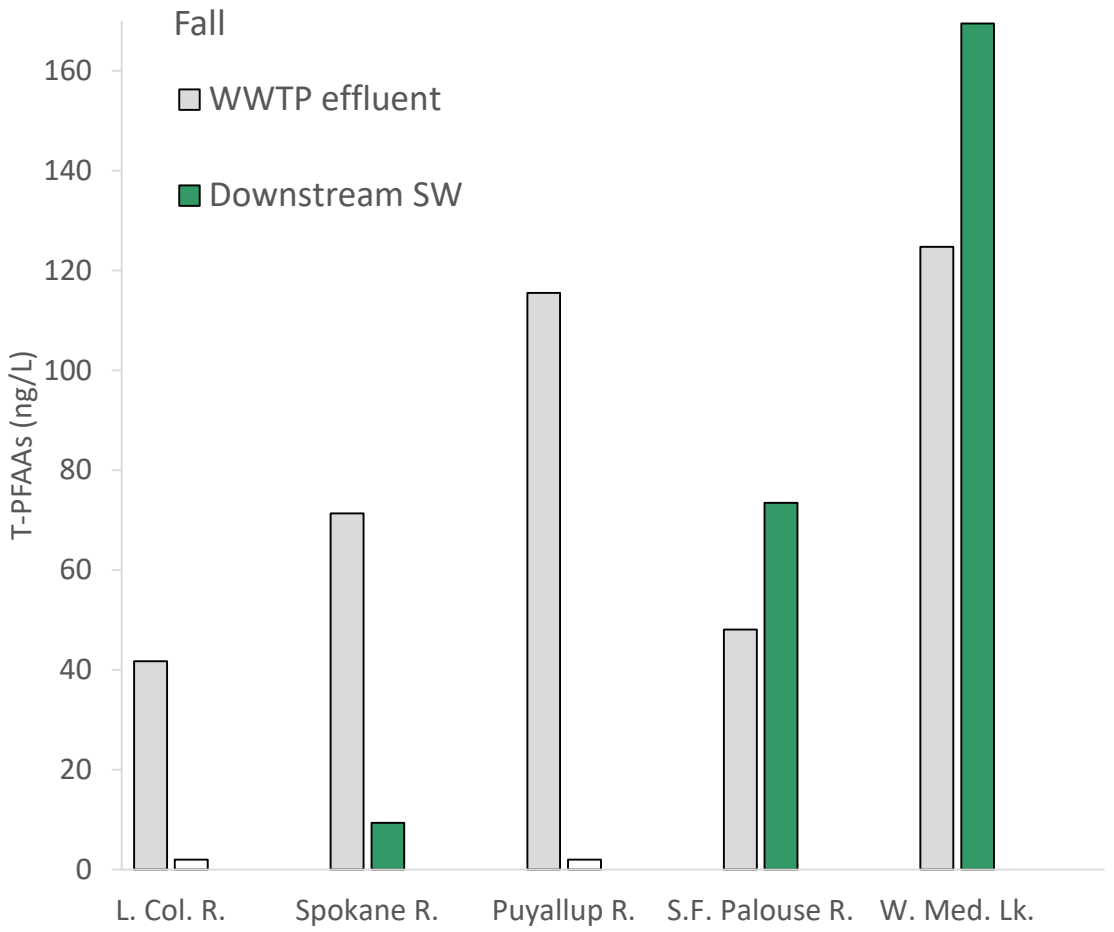
7 out of 15 samples contained PFASs.




short -chain
PFOA
PFOS
average WWTP effluent
average WWTP-impacted sites
average urban lakes
PFHxA
PFPeA
PFOA
PFOS
PFHpA
PFBA
PFBS
PFHxS
PFNA
PFDA
0%
25%
50%
75%
100%
Percent Relative Contribution of PFAA

WWTP Effluent → Surface Water





Freshwater Fish

11 sites – fall

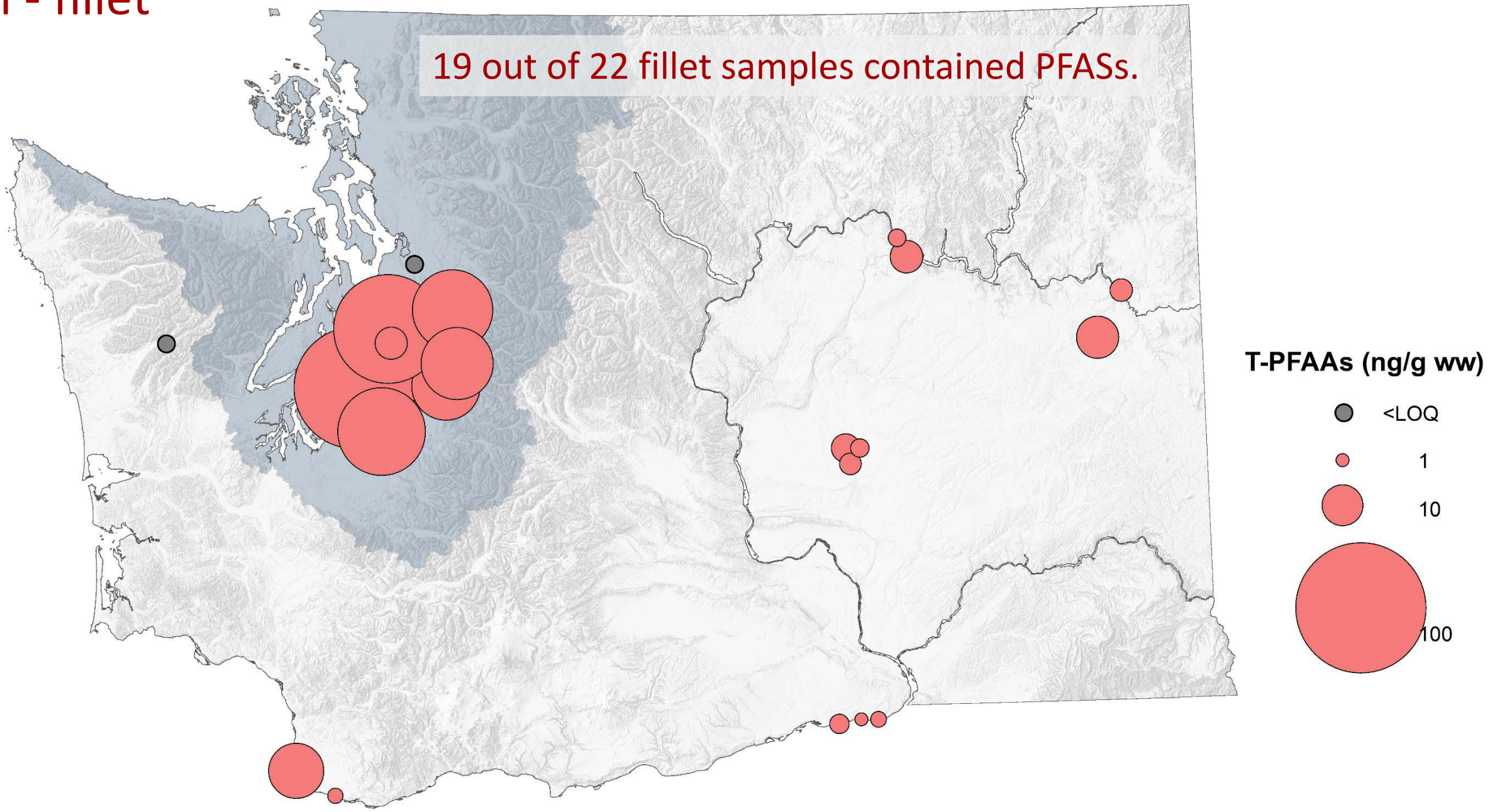
Upper/lower trophic species

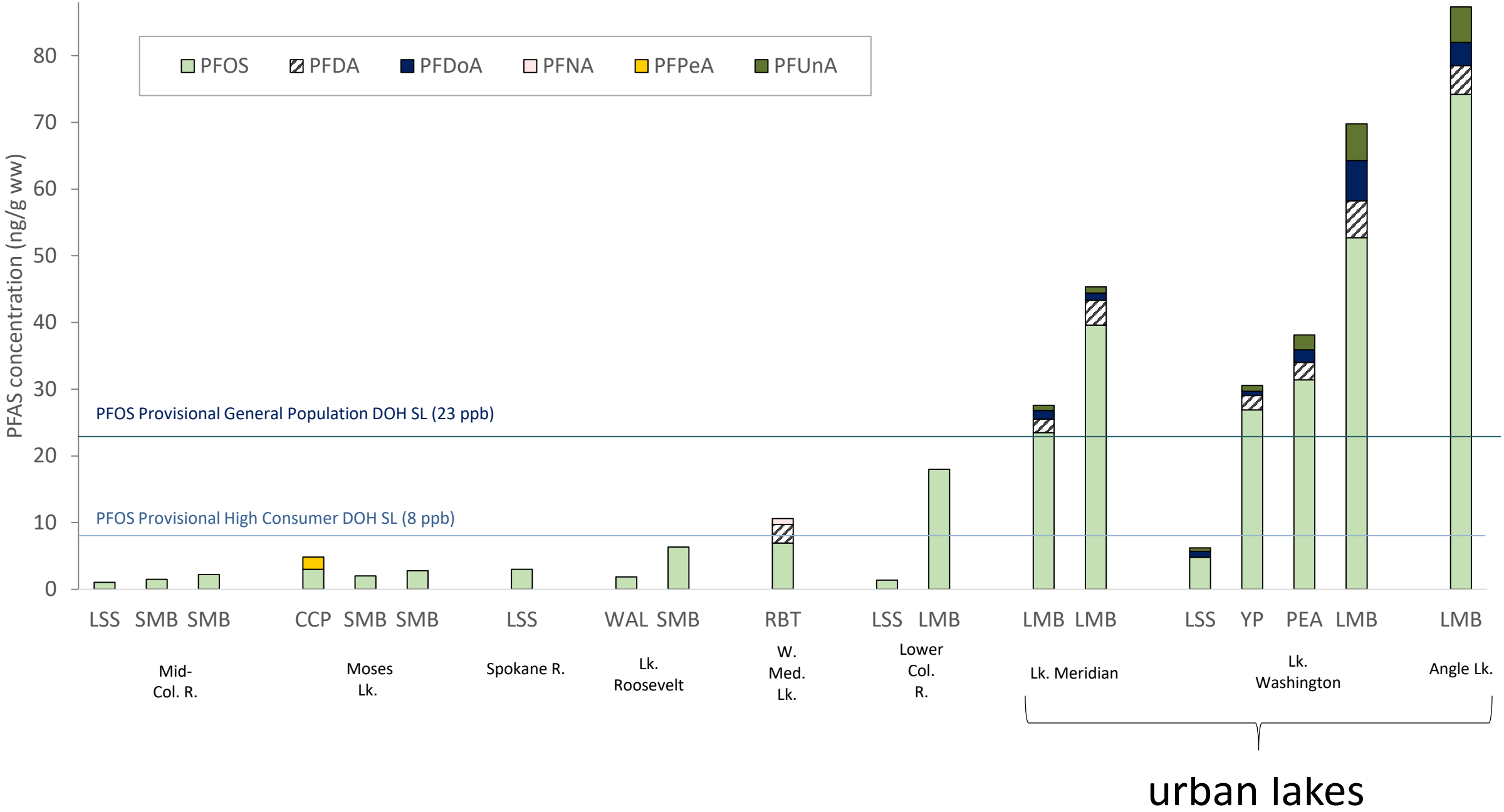
Fillet and liver

13 compounds – PFAAs + PFOSA

fish - fillet

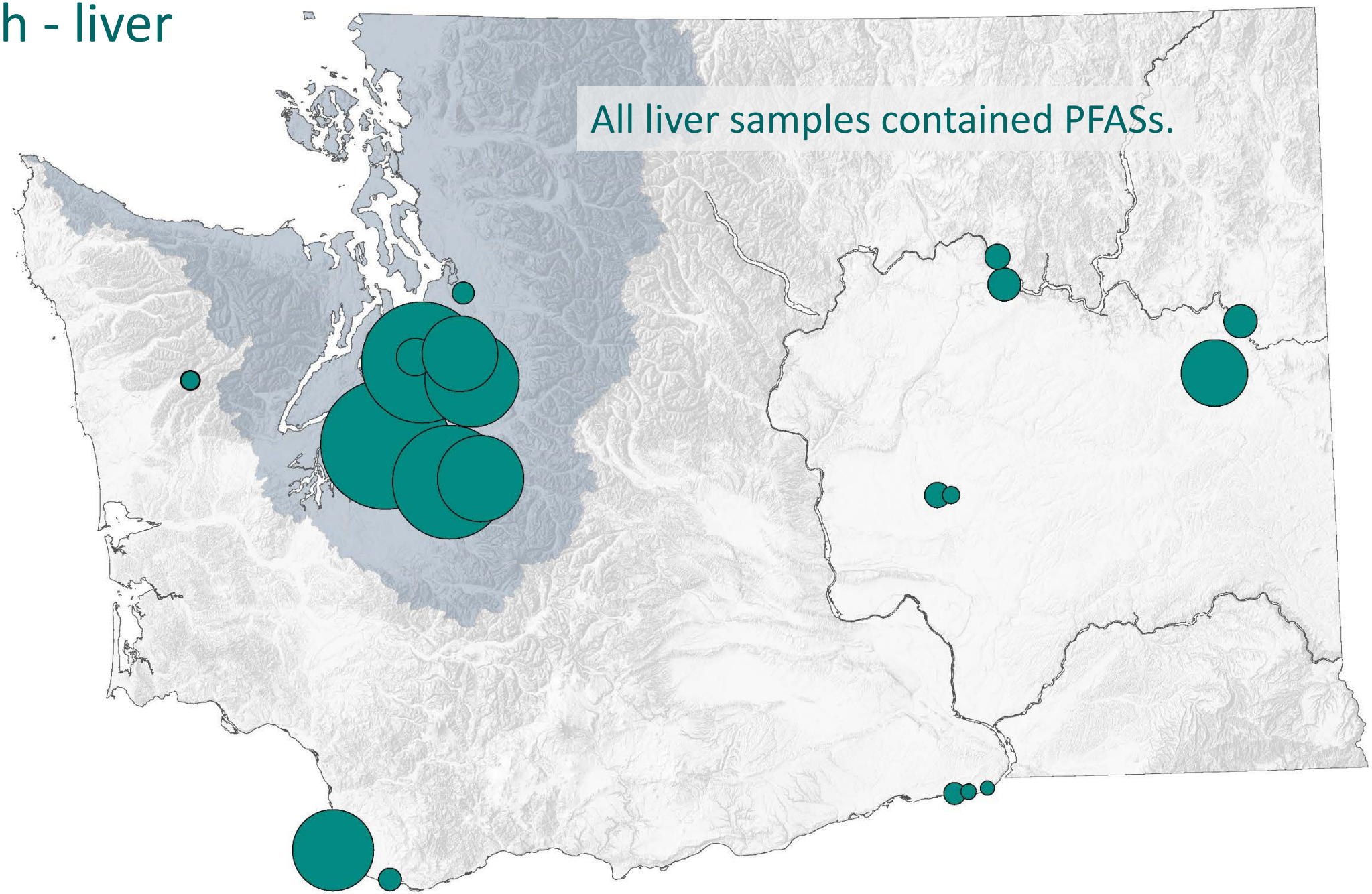
19 out of 22 fillet samples contained PFASs.



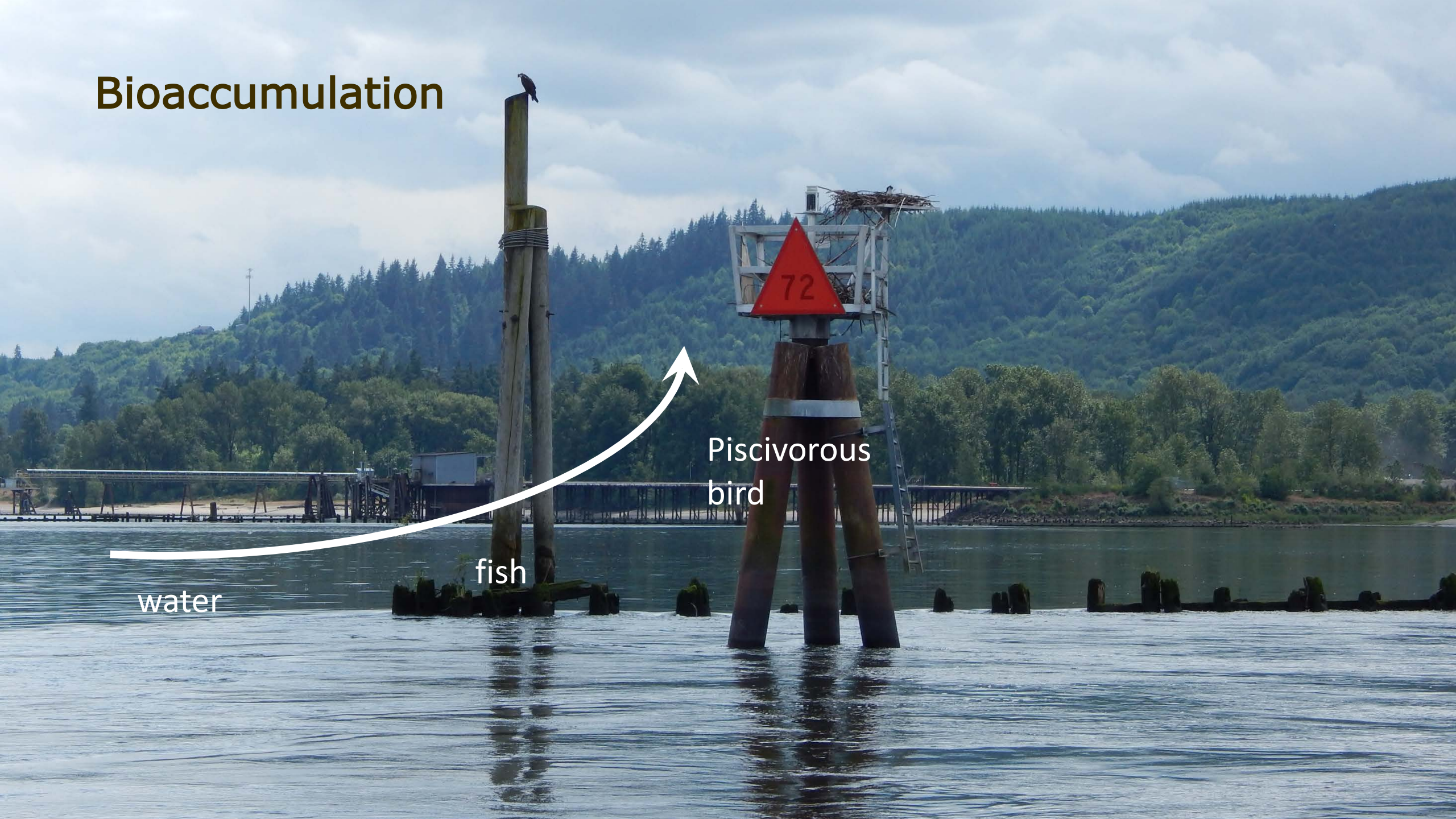

PFOS
PFDA
PFDoA
PFNA
PFPeA
PFUnA
PFAS concentration (ng/g ww)
0
10
20
30
40
50
60
70
80
PFOS Provisional General Population DOH SL (23 ppb)
PFOS Provisional High Consumer DOH SL (8 ppb)
LSS
SMB
SMB
CCP
SMB
SMB
LSS
WAL
SMB
RBT
LSS
LMB
LMB
LMB
LSS
YP
PEA
LMB
LMB
Mid-Col. R.
Moses Lk.
Spokane R.
Lk. Roosevelt
W. Med. Lk.
Lower Col. R.
Lk. Meridian
Lk. Washington
Angle Lk.
urban lakes

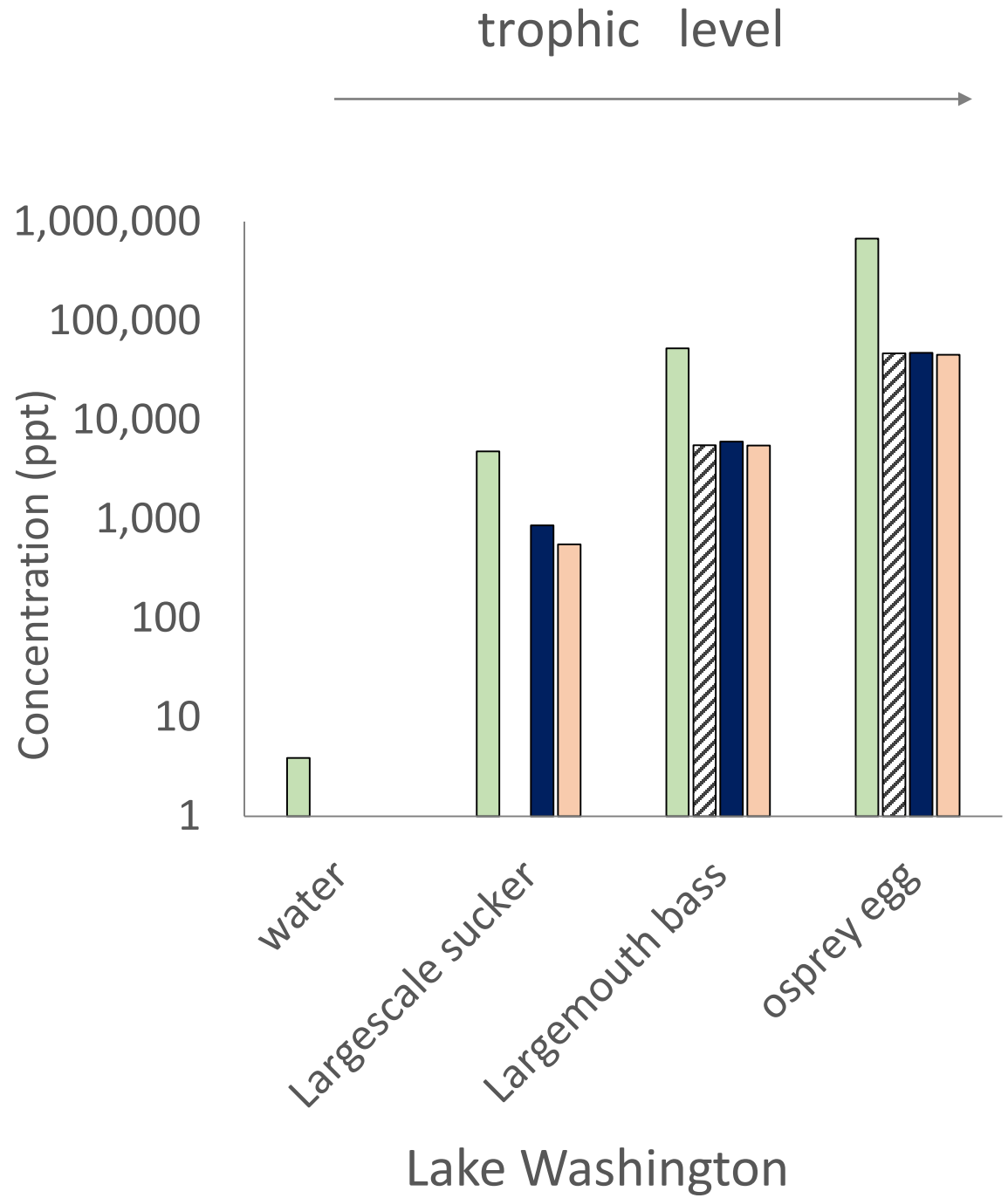
fish - liver

All liver samples contained PFASs.

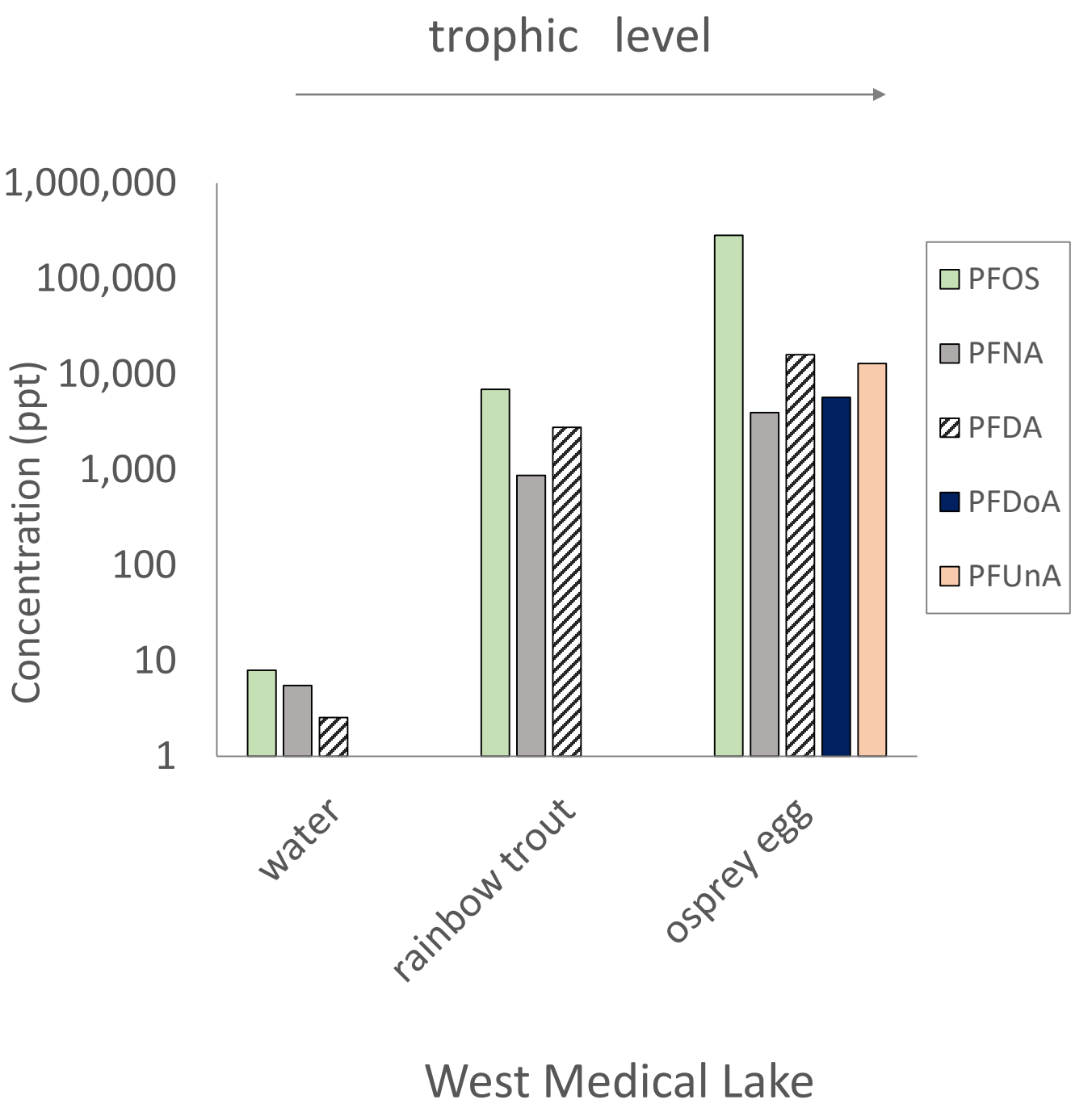


Bioaccumulation

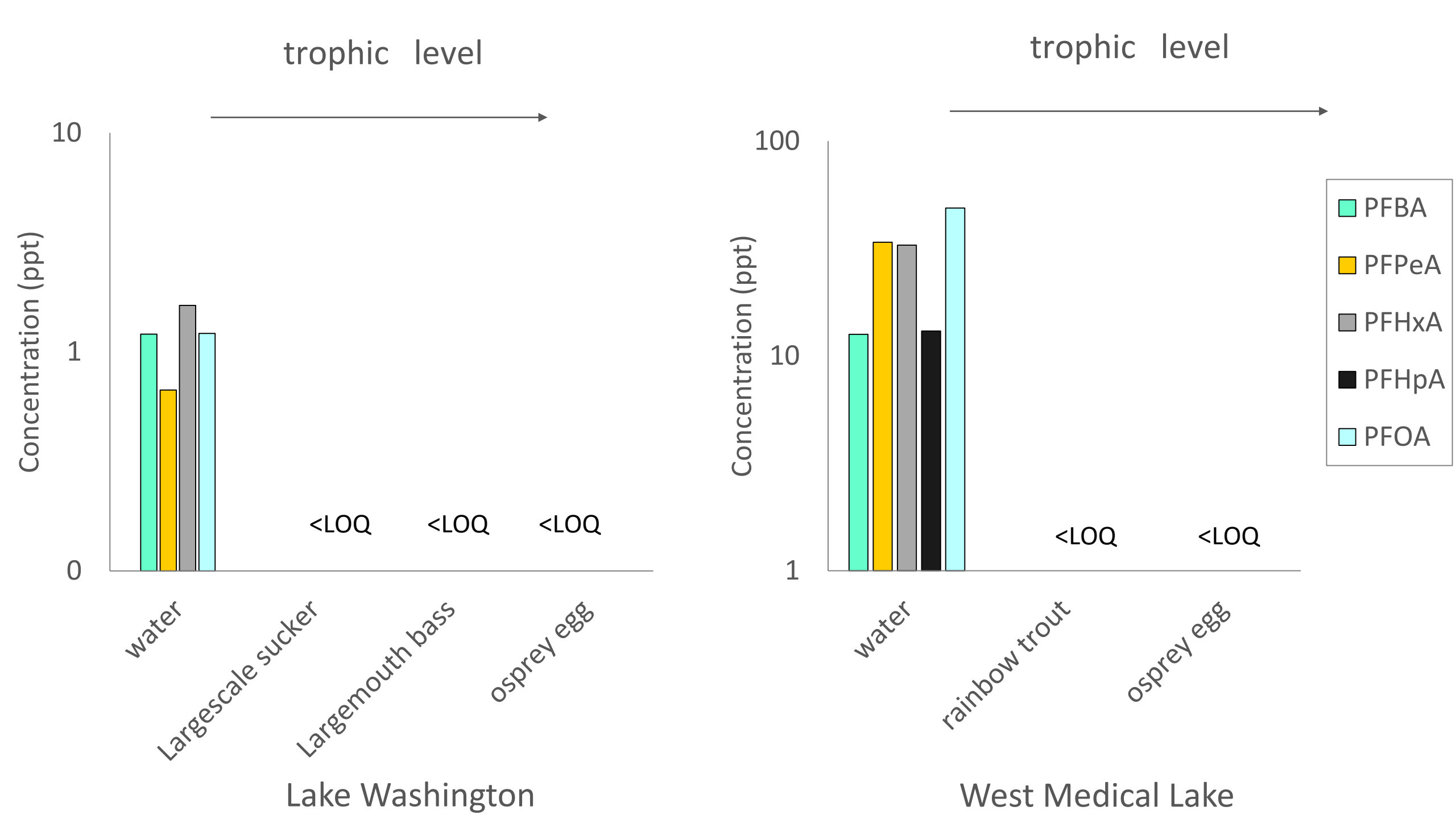


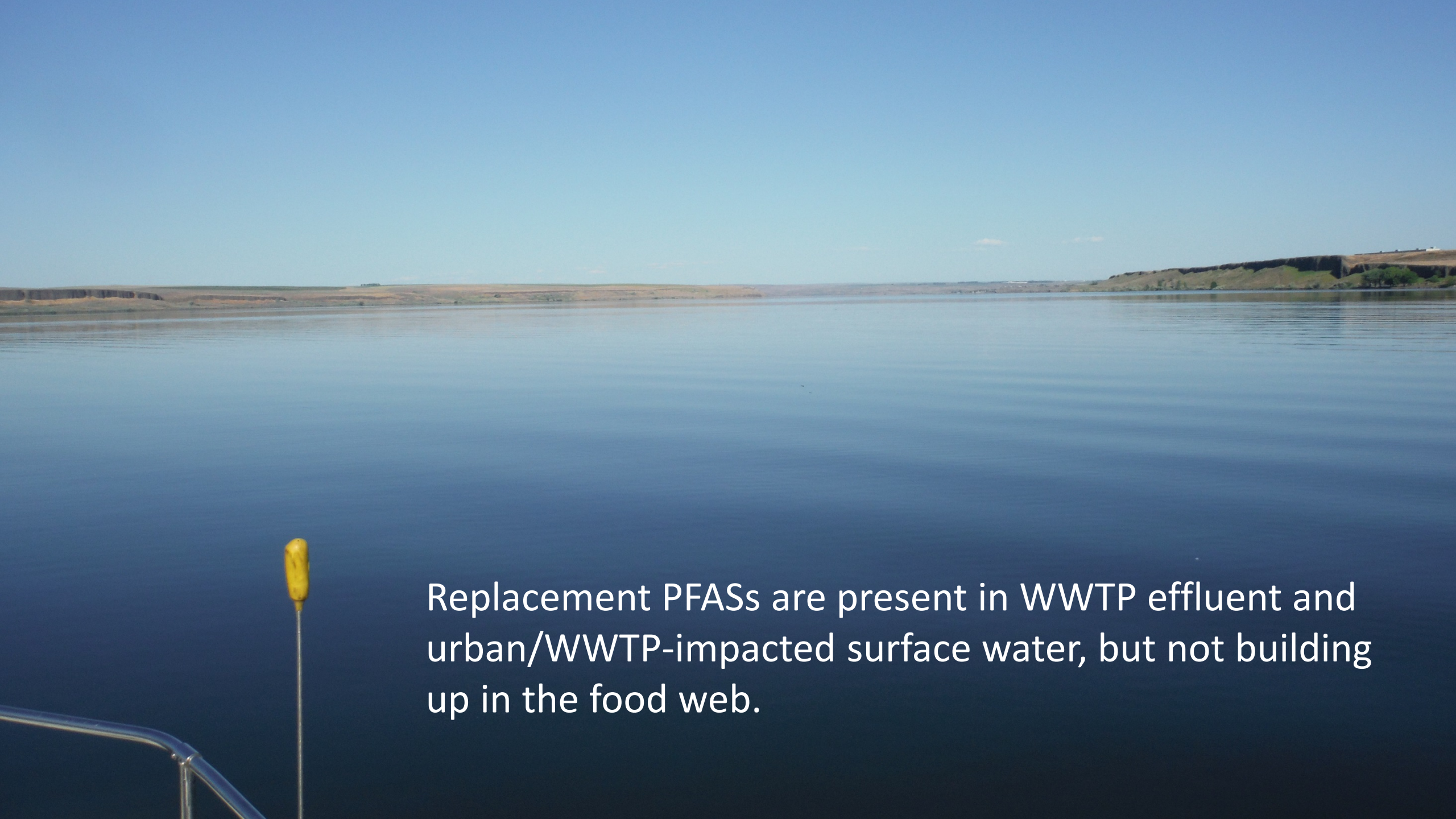


Lake Washington



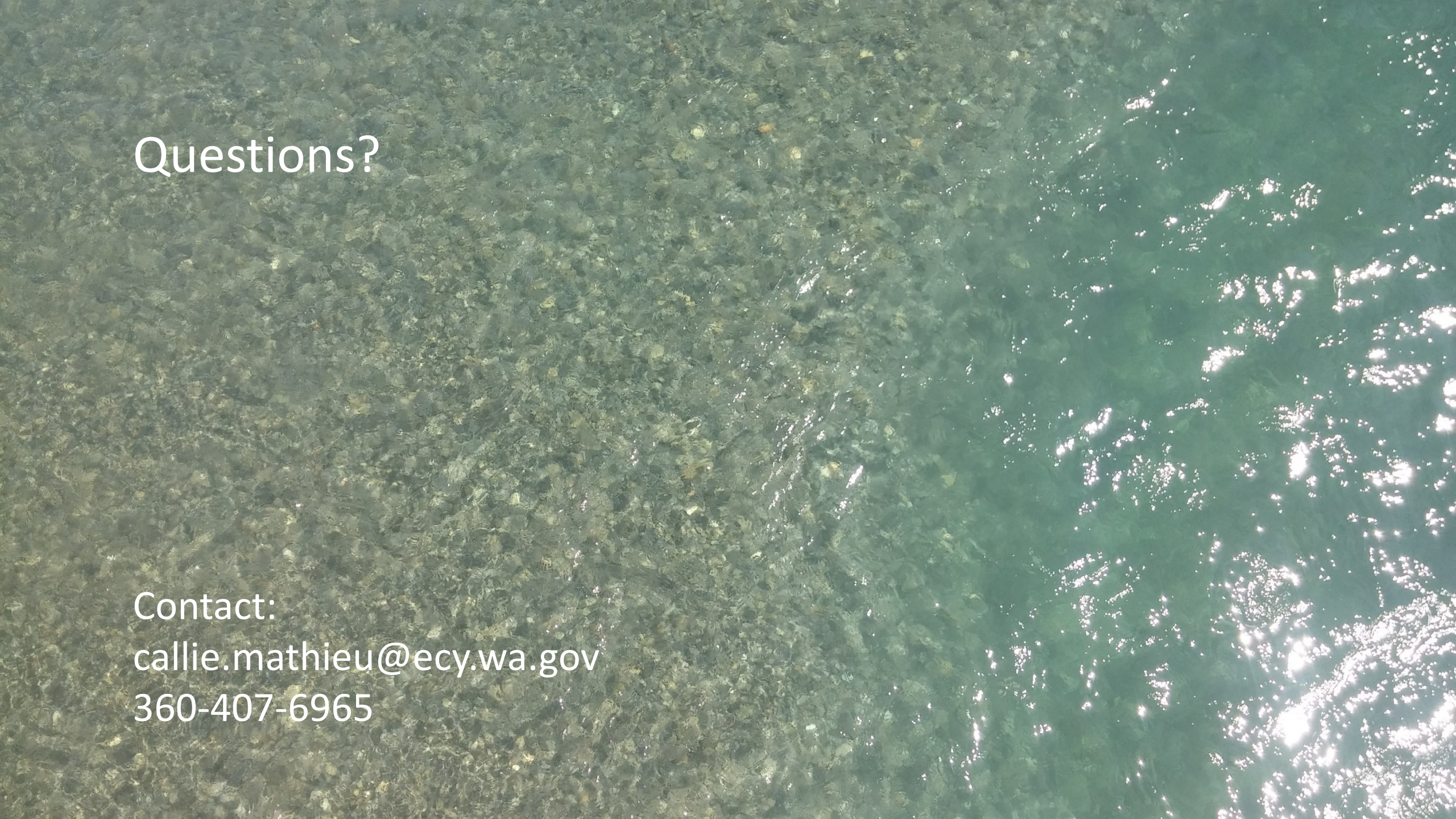
West Medical Lake


trophic level
10
1
0
Concentration (ppt)
<LOQ
<LOQ
<LOQ
water
Largescale sucker
Largemouth bass
osprey egg
Lake Washington
trophic level
100
10
1
Concentration (ppt)
<LOQ
<LOQ
water
rainbow trout
osprey egg
West Medical Lake
PFBA
PFPeA
PFHxA
PFHpA
PFOA



Replacement PFASs are present in WWTP effluent and urban/WWTP-impacted surface water, but not building up in the food web.


PFOS and long-chain PFASs are still ubiquitous in the aquatic food web, despite 15 years of phase out and concentrations are highest in urban lakes.



Questions?

Contact:
callie.mathieu@ecy.wa.gov
360-407-6965